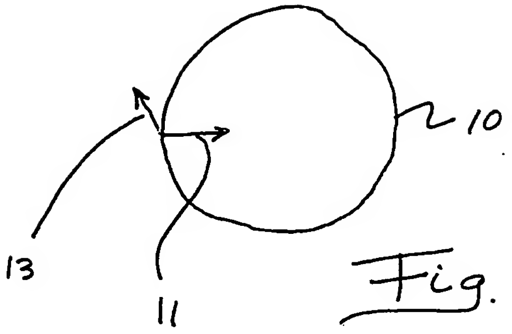


Fig. 1

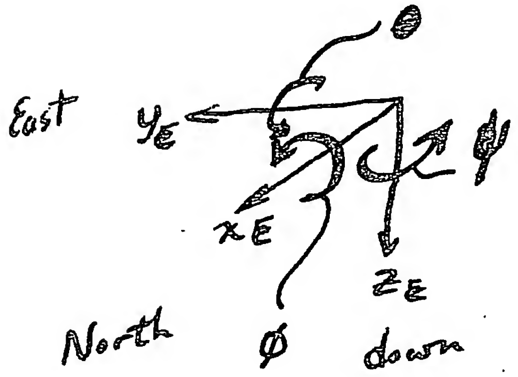


Fig 2(a)

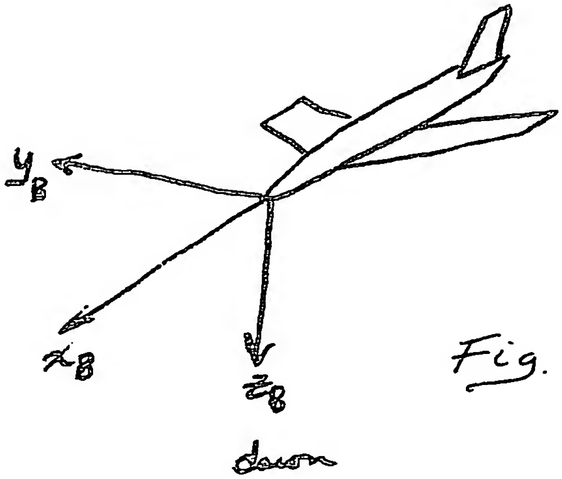


Fig. 2 (b)

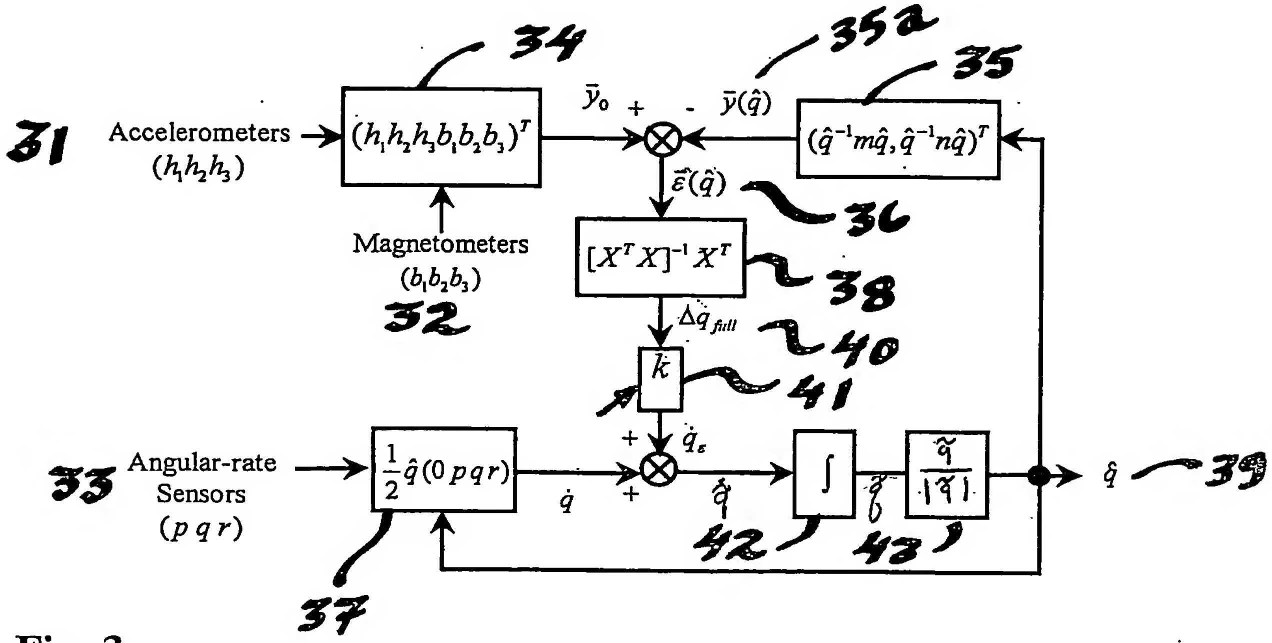

31
Accelerometers
$(h_1h_2h_3)$
$(h_1h_2h_3b_1b_2b_3)^T$
34
Magnetometers
$(b_1b_2b_3)$
32
$\vec{y}_0$
+
-
$\vec{y}(\hat{q})$
352
35
$(\hat{q}^{-1}m\hat{q}, \hat{q}^{-1}n\hat{q})^T$
$\vec{\varepsilon}(\hat{q})$
36
$[X^TX]^{-1}X^T$
38
$\Delta\dot{q}_{full}$
40
k
41
$\dot{q}_\varepsilon$
+
+
33
Angular-rate Sensors
$(p\,q\,r)$
$\frac{1}{2}\hat{q}(0\,p\,q\,r)$
$\dot{q}$
$\dot{\hat{q}}$
$\int$
$\tilde{q}$
$\frac{\tilde{q}}{|\tilde{q}|}$
$\hat{q}$
39
42
43
37

Fig. 3

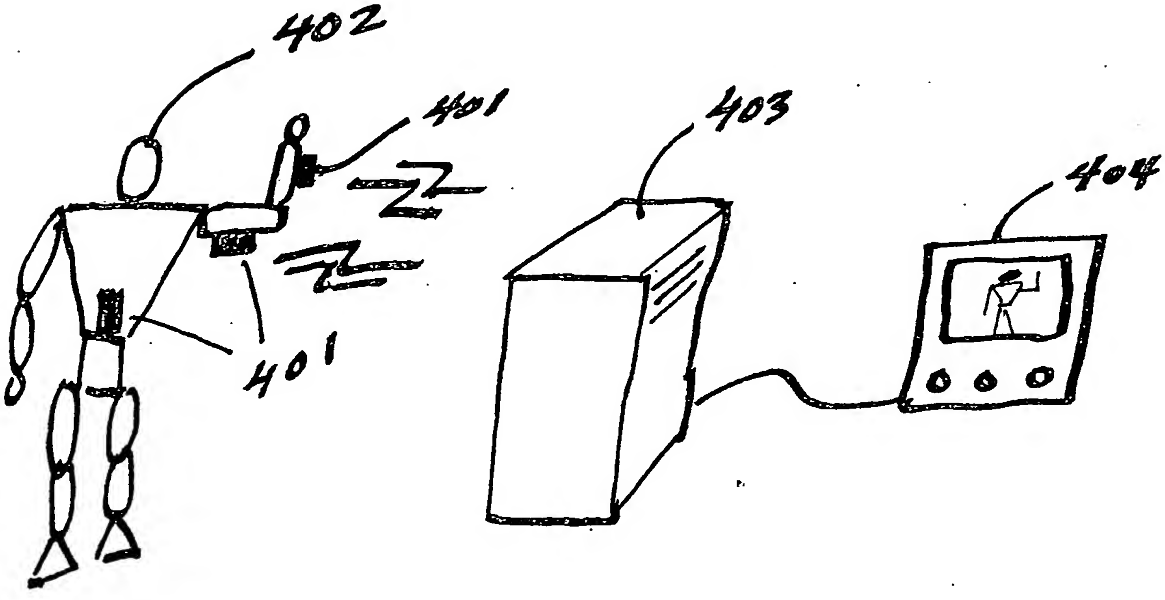

402
401
401
403
404

Fig. 4

Fig. 5

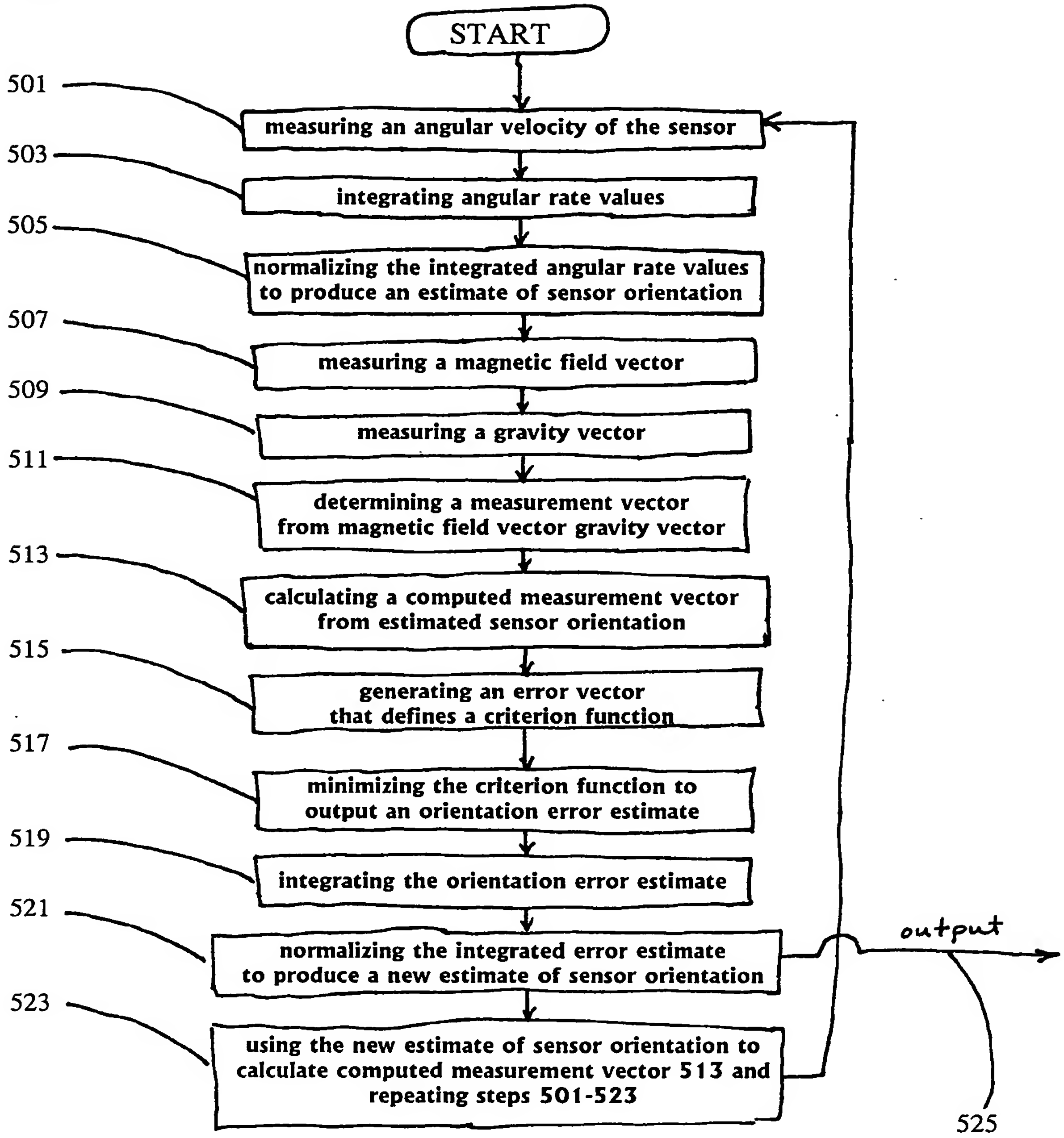
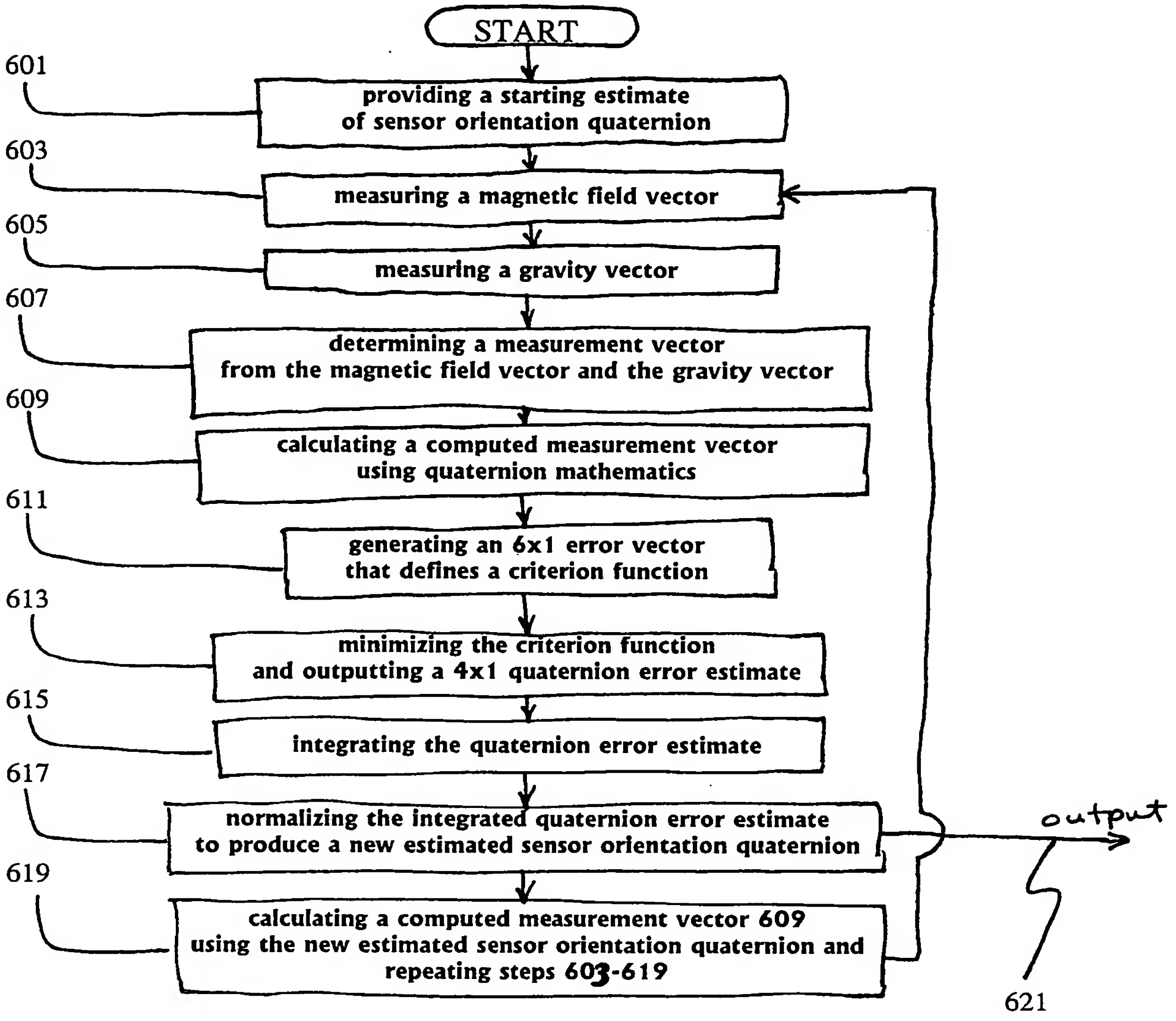

START
501
measuring an angular velocity of the sensor
503
integrating angular rate values
505
normalizing the integrated angular rate values to produce an estimate of sensor orientation
507
measuring a magnetic field vector
509
measuring a gravity vector
511
determining a measurement vector from magnetic field vector gravity vector
513
calculating a computed measurement vector from estimated sensor orientation
515
generating an error vector that defines a criterion function
517
minimizing the criterion function to output an orientation error estimate
519
integrating the orientation error estimate
521
normalizing the integrated error estimate to produce a new estimate of sensor orientation
output
523
using the new estimate of sensor orientation to calculate computed measurement vector 513 and repeating steps 501-523
525

Fig. 6


START
601
providing a starting estimate of sensor orientation quaternion
603
measuring a magnetic field vector
605
measuring a gravity vector
607
determining a measurement vector from the magnetic field vector and the gravity vector
609
calculating a computed measurement vector using quaternion mathematics
611
generating an 6x1 error vector that defines a criterion function
613
minimizing the criterion function and outputting a 4x1 quaternion error estimate
615
integrating the quaternion error estimate
617
normalizing the integrated quaternion error estimate to produce a new estimated sensor orientation quaternion
619
calculating a computed measurement vector 609 using the new estimated sensor orientation quaternion and repeating steps 603-619
output
621